TECHNICAL SERVICE MANUAL

GENERAL PURPOSE JACKETED PUMPS
SERIES 230
MODELS KK, LQ, Q, M, N

SECTION 2
BULLETIN TSM-230-V
ISSUE B. 4/2009

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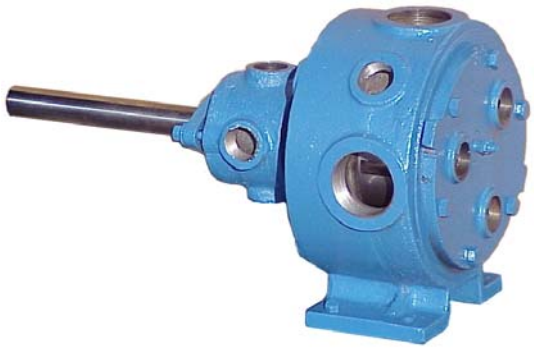
INTRODUCTION

The illustrations used in this manual are for identification purposes only and cannot be used for ordering parts. Obtain a parts list from the factory or a Viking representative. Always give complete name of part, part number and material with model number and serial number of pump when ordering repair parts. The pump model number and serial number are on the nameplate.

In the Viking model number system, basic size letters are combined with series number.

UNMOUNTED PUMP	UNITS
	Units are designated by the unmounted pump model numbers followed by “Arrangement” indicating drive style.
KK-230	
LQ-230	
Q-230	
M-230	
N-230	13-Direct Connected
	53-V-Belt Drive
	70-Commercial Speed Reducer

This manual deals only with Series 32 General Purpose Bracket Mounted Pumps. Pump specifications and recommendations are listed in Catalog Section 2, Series 32 General Purpose Pumps.



KK-230 with Jacketed casing,head, and rotor bearing sleeve.

DANGER

BEFORE OPENING ANY PUMP LIQUID CHAMBER (PUMPING CHAMBER, RESERVOIR, RELIEF VALVE ADJUSTING CAP FITTING ETC.) BE SURE:

1. THAT ANY PRESSURE IN CHAMBER HAS BEEN COMPLETELY VENTED THROUGH SUCTION OR DISCHARGE LINES OR OTHER APPROPRIATE OPENINGS OR CONNECTIONS.
2. THAT THE DRIVING MEANS (MOTOR, TURBINE, ENGINE, ETC.) HAS BEEN "LOCKED OUT" OR MADE NON-OPERATIONAL SO THAT IT CANNOT BE STARTED WHILE WORK IS BEING DONE ON PUMP.
3. THAT YOU KNOW WHAT LIQUID THE PUMP HAS BEEN HANDLING AND THE PRECAUTIONS NECESSARY TO SAFELY HANDLE THE LIQUID. OBTAIN A MATERIAL SAFETY DATA SHEET (MSDS) FOR THE LIQUID TO BE SURE THESE PRECAUTIONS ARE UNDERSTOOD.

FAILURE TO FOLLOW ABOVE LISTED PRECAUTIONARY MEASURES MAY RESULT IN SERIOUS INJURY OR DEATH.

ROTATION: Rotary gear pumps operate equally well in a clockwise or counterclockwise rotation. The shaft rotation determines which port is suction and which is discharge. Port in area where pumping elements (gear teeth) come out of mesh is suction port.

PRESSURE RELIEF VALVES:

1. Rotary gear pumps are positive displacement pumps and must be provided with some sort of pressure protection. This may be a relief valve mounted directly on the pump, an inline pressure relief valve, a torque limiting device or a rupture disk.

2. There are relief valve options available on those pump models designed to accept a relief valve. Options may include a return to tank relief valve and a jacketed relief valve. Pumps equipped with a jacketed head are not available with a relief valve.

3. If pump rotation is reversed during operation, pressure protection must be provided on *both* sides of pump.

4. Relief valve bonnet must *always* point towards suction side of pump. If pump rotation is reversed, remove pressure relief valve and turn end for end. Figures 2 and 3 show the 2 possible configurations, Figure 2 has side suction and top discharge. Figure 3 has top suction and side discharge. The shaft turns in the opposite direction on the second pump.

5. Pressure relief valves cannot be used to control pump flow or regulate discharge pressure.

Figure 2

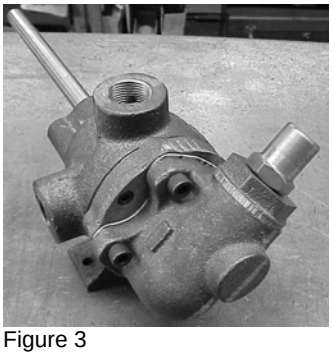


Figure 3

SPECIAL INFORMATION

SPECIAL MECHANICAL SEALS can be installed either next to rotor hub or behind the bracket bushing.

Extra care must be taken in repair of pumps with mechanical seals. Read and follow all special information supplied with pump.

MAINTENANCE

Series 32 pumps are designed for long, trouble-free service life under a wide variety of application conditions with a minimum of maintenance. The points listed below will help provide long service life.

LUBRICATION: External lubrication must be applied slowly with a handgun to all lubrication fittings every 500 hours of operation with multi-purpose grease. Do not over-grease. Applications involving very high or low temperatures will require other types of lubrication. Consult factory with specific lubrication questions.

PACKING ADJUSTMENT: New packed pumps require initial packing adjustment to control leakage as packing "runs in". The adjustment should be made while the pump is operating with normal operating pressure on the discharge of the pump. Make adjustments carefully and do not over-tighten packing gland. Evenly tighten the gland fasteners until the leak is reduced to a very slow drip. If over tightened the packing will over heat, score the shaft and reduce life. After initial adjustment, inspect periodically for increased leakage and re-adjust. Once the gland has been tightened to the stuffing box, loosen the packing gland and add one ring to the stuffing box, then adjust again. Refer to instructions under Disassembly, page 6, and Assembly, page 7, regarding repacking pump.

CLEANING PUMP: Keep pump as clean as possible. This will facilitate inspection, adjustment and repair work and help prevent overlooking a dirt covered grease fitting.

STORAGE: If pump is to be stored, or not used for six months or more, pump must be drained and a light coat of lubricant and rust preventative suitable to the application must be applied to all internal pump parts. Lubricate fittings and apply grease to pump shaft extension. Viking suggests rotating pump shaft by hand, one complete revolution every 30 days to circulate the oil.

SUGGESTED REPAIR TOOLS: The following tools must be available to properly repair Series 32 pumps. These tools are in addition to standard mechanics' tools such as open-end wrenches, pliers, screwdrivers, etc. Most of the items can be obtained from an industrial supply house.

1. Soft Headed hammer
2. Allen wrenches (some mechanical seals and set collars)
3. Packing hooks, flexible (packed pumps)
   Small for 1/4 inch and 3/8 inch cross section packing
   Large for 3/8 inch and larger cross section packing
4. Arbor press

Strainers: Use a strainer on the suction side of the pump to prevent foreign material from entering the pump causing damage to the gears, and casing or lock-up the pump. Keep the strainer on the suction side of the pump clean and free of debris. A blocked strainer will not allow sufficient liquid to reach the pump. The lack of liquid reaching the pump will create cavitation. Cavitation is when the liquid vaporizes on its way to the pump, then returns to a liquid form on the surfaces of the pump. This is very noisy, damaging to a pump, and seriously affects the output.

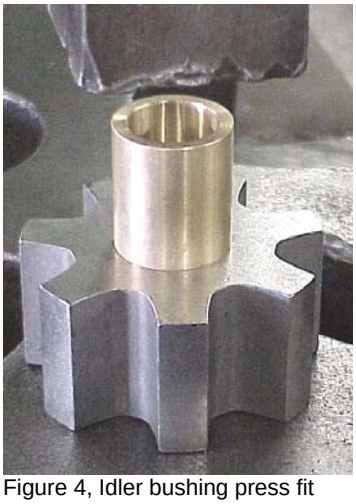


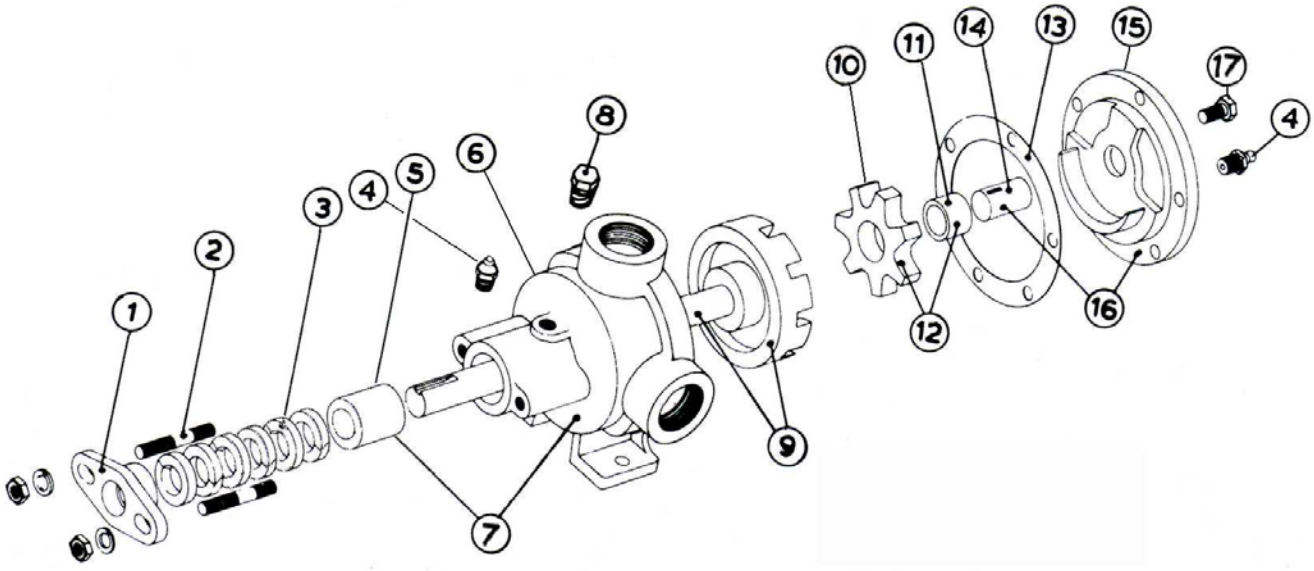
Figure 4, Idler bushing press fit

Figure 5, Pressing the idler pin

Figure 6, Casing bushing orientation

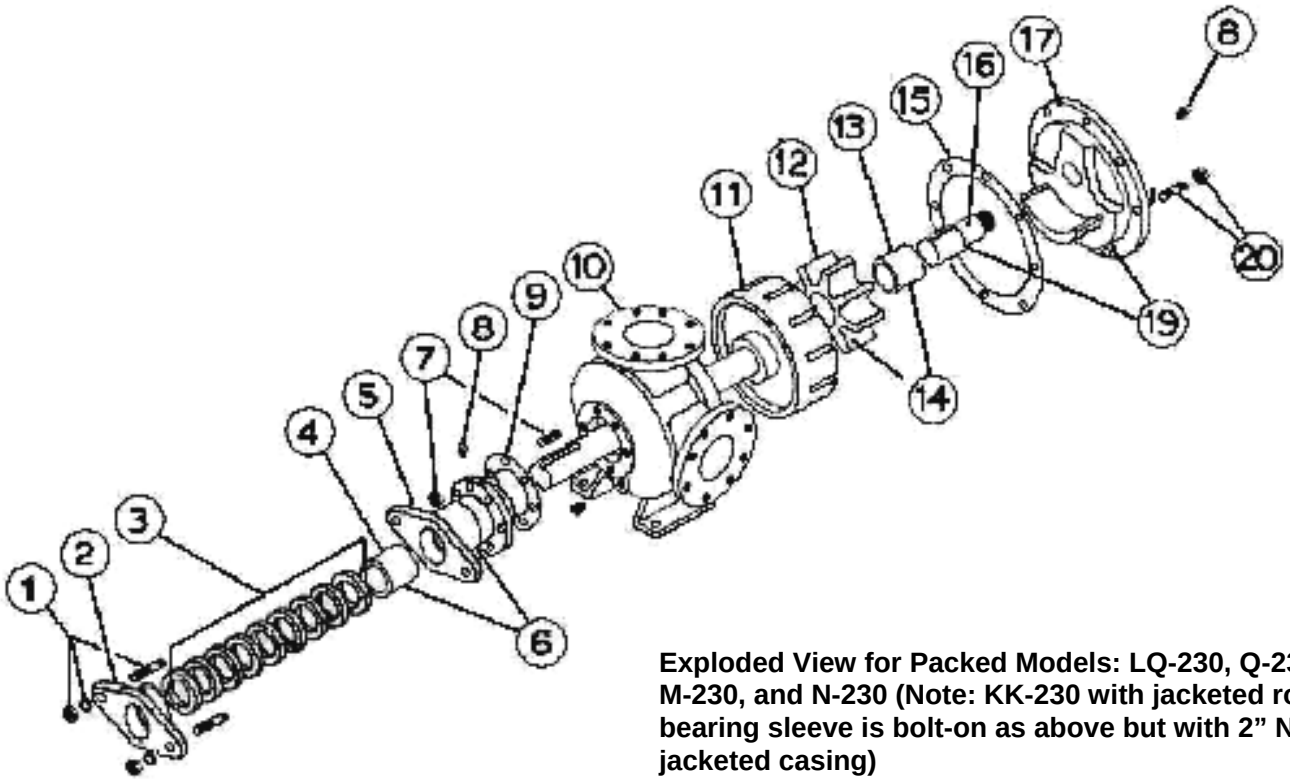
Figure 7, Casing, rotor & shaft ass'y

PACKED PUMPS



Exploded View for Packed Models: KK-230 (with non-jacketed rotor bearing sleeve)

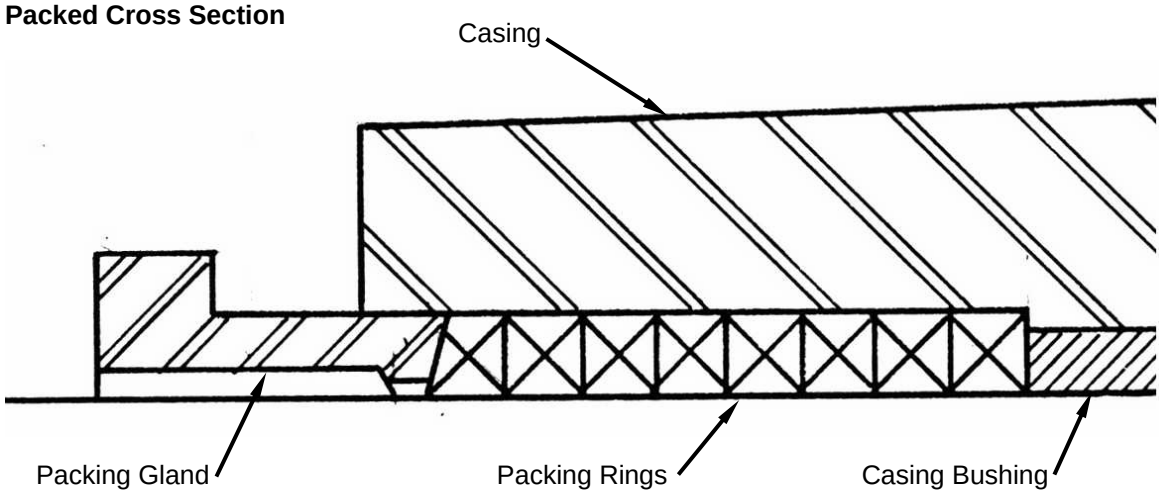
ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Packing Gland	7	Jacketed casing and bushing ass'y	13	Head Gasket
2	Packing Gland fasteners	8	Pipe Plug	14	Idler pin
3	Packing rings	9	Rotor and Shaft assembly	15	Head
4	Grease fitting	10	Idler	16	Head and Idler Pin assembly
5	Rotor Bearing Sleeve bushing	11	Idler bushing	17	Head fasteners
6	Jacketed casing	12	Idler and Bushing assembly		



Exploded View for Packed Models: LQ-230, Q-230, M-230, and N-230 (Note: KK-230 with jacketed rotor bearing sleeve is bolt-on as above but with 2" NPT jacketed casing)

ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Packing gland fasteners	8	Grease fitting	15	Head gasket
2	Packing Gland	9	RBS Gasket	16	Idler pin
3	Packing rings	10	Jacketed Casing	17	Head
4	RBS bushing	11	Rotor and shaft ass'y	18	Nut – no longer used
5	Rotor Bearing Sleeve (RBS)	12	Idler	19	Head and idler pin ass'y
6	RBS and bushing ass'y	13	Idler bushing	20	Head fasteners
7	RBS fasteners	14	Idler and bushing ass'y	21	Pipe plug

Packed Cross Section



DISASSEMBLY OF PACKED PUMPS

Note: For large pump models the use of a lifting device is advised.

1. Remove the packing gland fastener, and pull the gland out of the stuffing box, and off of the shaft.

2. Mark head and casing before disassembly to insure proper re-assembly. The idler pin, which is offset in pump head, must be positioned toward and centered between the port connections to allow for proper flow of liquid through pump. Figure 1, page 2.

   Remove head from pump. *Do not allow idler to fall from idler pin.* Tilt top of head back and down when removing to prevent this. The idler and bushing should stay on the idler pin. If pump is furnished with pressure relief valve, it need not be removed from head or disassembled at this point. Refer to Pressure Relief Valve Instructions, page 12.

   The gaskets must be totally removed. Use new gasket when assembling pump.

3. Remove idler and bushing assembly from the idler pin.

4. Tap the shaft forward with a softheaded hammer, and pull it out of the casing and bushing assembly. Large assemblies can be supported with a hoist and rope or strap around a rotor tooth.

5. The packing may be removed with a packing puller. In some cases two pullers will be required, or pushed out with a chisel and a hammer from the bushing side (be careful not to damage the bushing). If removal, still cannot be done with the pullers, or chisel, stand the casing on the face of the stuffing box and press the bushing out through the packing area. This will remove all of the packing with the bushing.

6. Clean all parts thoroughly and examine for wear and damage. Check all parts for nicks, burrs, excessive wear and replace if necessary.

7. Check the bearings for roughness. Roughness can be determined by turning the inner and outer race in opposite directions by hand. Note if the motion is smooth and free or rough and stiff. Smooth and free is desired.

8. The casing bushing can also be inspected while still in the casing. If replacement is necessary, and not already removed in step 5, stand the unit on the head-mounting surface and push the bushing out with a round bar through the packing end of the casing.

Note: For models Q, M, and N the rotor bearing sleeve can be removed from the casing to make removal of the bushing easier.

9. If the idler pin is worn, remove the grease fitting, and support the casing on the crescent side as close as possible to the idler pin. Press the pin out.

10. If the idler bushing is worn it can be pressed out of the idler. However the idler will likely be worn as mush as the bushing, therefore it is recommended that the complete assembly be replaced.

Figure 8, Mounting head

Figure 9, Alternate the packing cuts

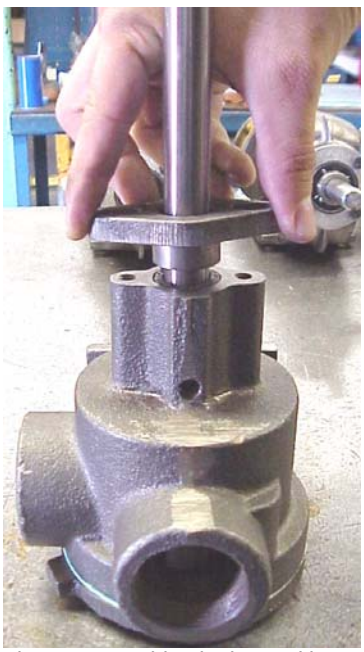


Figure 10, Pushing in the packing rings

ASSEMBLY OF PACKED PUMPS

Rotary gear pumps are supplied with a wide variety of bushing materials. These materials should not all be treated the same. See “Bushing Material” page 11.

1. Press the idler bushing into the idler gear. Figure 4, page 3. Refer to Installation of Carbon Graphite Bushing see page 11.

Note: Some bushings have a small step in the diameter on one end to assist in the alignment and starting.

2. Coat the idler pin with non-detergent SAE 30 weight oil and using the idler bushing as a guide, press the idler pin into the head with the tapped hole in and the groove pointing toward the center of the crescent. Figure 5, page 3

3. Install the casing bushing. If the bushing has a lubrication groove, install bushing with the lubrication hole aligned with the grease-fitting hole on the casing. Figure 6, page 3. If carbon graphite, refer to Installation of Carbon Graphite Bushings, page 11.

Note: Q, M, and N pumps have RBS bushings installed in the rotor bearing sleeve which is mounted on the back side of the casing. Figure 12 & 13

4. Coat the shaft of the rotor and shaft assembly with non-detergent SAE 30 weight oil. Start the end of shaft in the casing bushing and slowly push the shaft through bushing. Continue until the rotor and shaft assembly cannot move any further. Figure 7, page 3.

5. Perform all step in “END CLEARANCE ADJUSTMENT” page 11,

6. Use only new packing suitable for the liquid being pumped. Install the packing, staggering the joints from one side of shaft to other, Figure 9, page 6. If needed, lubricate packing rings with oil, grease or graphite to aid assembly. Use the packing gland or a length of pipe to seat each packing ring, Figure 10, page 6.

7. Install packing gland, capscrews and nuts. Make sure the gland is installed square and nuts are only finger tight. Figure 11. Refer to “Packing Adjustment” page 2 after the pump is assembled and installed.

8. Replace the grease fittings and pipe plugs.

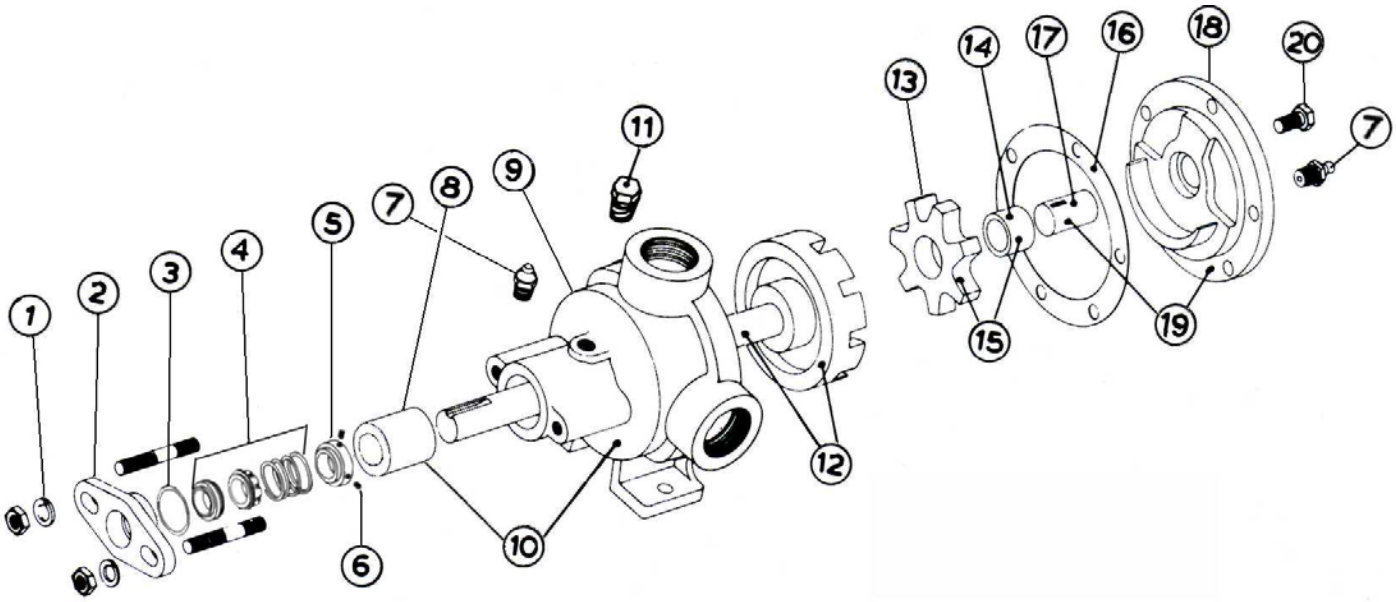
9. Lubricate all grease fittings with multi-purpose grease.

Figure 11, Gland & fasteners installed

Figure 12, RBS bushing installation

Figure 13, Installing the Seal

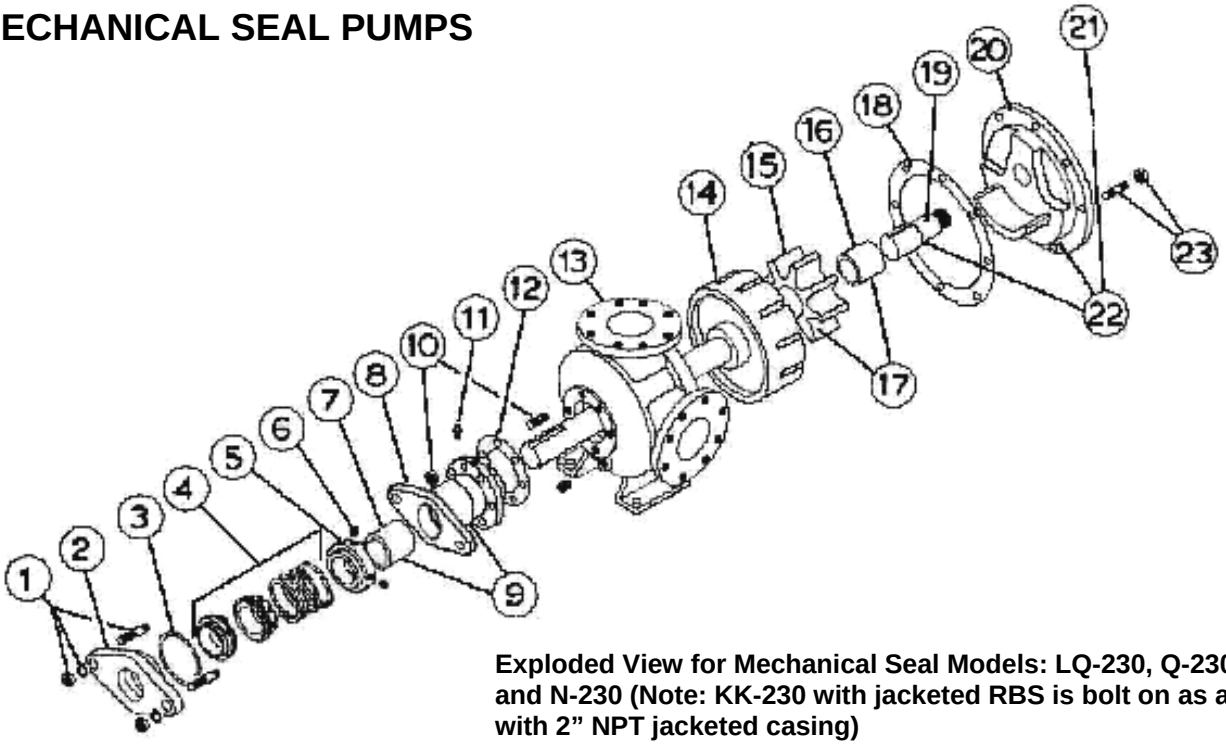
MECHANICAL SEAL PUMPS



Exploded View for Mechanical Seal Models: KK-230 (with non-jacketed rotor bearing sleeve)

ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Seal seat retainer fasteners	8	Casing bushing	15	Idler and bushing assembly
2	Seal seat retainer	9	Jacketed Casing	16	Head gasket
3	Retainer o-ring	10	Casing and bushing assembly	17	Idler pin
4	Mechanical seal assembly	11	Pipe plug	18	Head
5	Driving ring	12	Rotor and shaft assembly	19	Head & pin assembly
6	Set screw	13	Idler	20	Head fasteners
7	Grease fitting	14	Idler bushing		

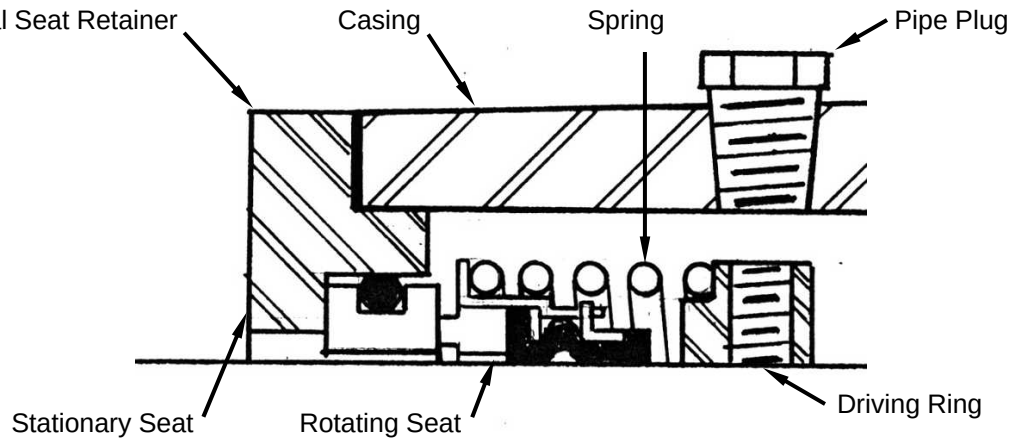
MECHANICAL SEAL PUMPS



Exploded View for Mechanical Seal Models: LQ-230, Q-230, M-230, and N-230 (Note: KK-230 with jacketed RBS is bolt on as above but with 2" NPT jacketed casing)

ITEM	NAME OF PART	ITEM	NAME OF PART
1	Seal seat retainer fasteners	13	Jacketed Casing
2	Seal seat retainer	14	Rotor and Shaft assembly
3	Retainer o-ring	15	Idler
4	Mechanical seal assembly	16	Idler Bushing
5	Driving Ring	17	Idler and Bushing assembly
6	Set Screws	18	Head Gaskets
7	RBS Bushing	19	Idler Pin
8	Rotor Bearing Sleeve (RBS)	20	Head
9	RBS & Bushing assembly	21	No longer used
10	RBS fasteners	22	Head and Pin assembly
11	Grease fitting	23	Head fasteners
12	RBS Gasket		

Mechanical Seal Cross Section



DISSASSEMBLY OF SEALED PUMPS

1. Remove the fasteners from the seal seat retainer and pull it away from the seal chamber. Remove the rotating seat and the spring from the shaft.

2. Remove the pipe plug from the casing in the side of the seal chamber and loosen the 2 setscrews on the driving ring through the tapped hole in the side of the seal chamber. Figure 16

3. Remove the driving ring from the shaft.

4. Do steps 2 through 4 under “DISASSEMBLY OF PACKED PUMPS”.

5. Do steps 6, through 10 under “DISASSEMBLY OF PACKED PUMPS”

Figure 14, Install stationary seat

ASSEMBLY OF SEALED PUMPS

The seal used in this pump is simple to install and good performance will result if care is taken during installation.

The principle of the mechanical seal is that contact between the rotary and stationary members. These parts are lapped to a high finish and their sealing effectiveness depends on complete contact.

A number of pumps are supplied with special mechanical seals. These special seals are not discussed in TSM 32. Information is available by contacting the factory. When requesting special seal information, be sure to give pump model number and serial number.

There is a wide variety of bushing materials available, these materials should not all be treated the same. See “Bushing Material” page 11.

1. Repeat steps 1 through 5 of Packed Pump Assembly.

2. Clean the oil off of the shaft, and apply lubricant as recommended by your seal supplier to the shaft, the inner diameter of the rotating element, and the outer diameter of the stationary element of the mechanical seal.

3. Place the o-ring in the small groove in the seal seat.

4. Press the stationary seat into the seal seat retainer while protecting the face as pictured in figure 14.

5. Place the spring on driving ring with the setscrews already started in the threads. Put the spring and ring on the shaft.

6. Slide the rotary member with the lapped contact surface facing away from spring onto shaft until it is in the spring. Figure 15.

7. Push the seal seat, spring and driving ring into the stuffing box so that the driving ring is visible through the access hole in the side of the seal chamber. Rotate the shaft until the setscrews are accessible, then tighten down the two setscrews on the ring. Figure 16

8. Put the seal seat retainer on the shaft with the stationary element facing toward the rotating element on the shaft.

9. Start the fasteners on the retainer, and tighten by hand until the seal faces touch and a small amount of pressure is applied by the spring. Check that the retainer is centered and square with the shaft.

10. Tighten the fasteners evenly and in small increments. Figure 17

11. Replace the pipe plug in the hole in the side of the seal chamber.

10. Replace the grease fittings and pipe plugs.

11. Lubricate all grease fittings with multi-purpose grease.

Figure 15, Setting the driving ring

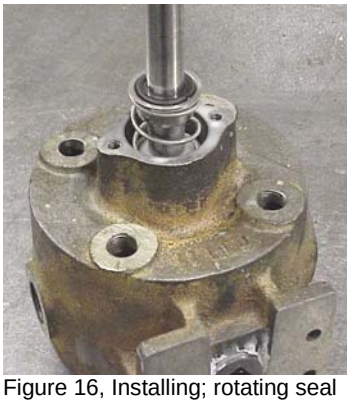


Figure 16, Installing; rotating seal components

Figure 17, Seal seat retainer installed

INSTALLATION OF CARBON GRAPHITE BUSHINGS

When installing carbon graphite bushings, extreme care must be taken to prevent breaking. Carbon graphite is a brittle material and is easily cracked. If cracked, the bushing will quickly disintegrate. Using a lubricant and adding a chamfer on the bushing and the mating part will help in installation. The additional precautions listed below must be followed for proper installation:

1. A press must be used for installation.
2. Lubricate the bushing and bore with soapy water.
3. Be certain bushing is started straight.
4. Do not stop pressing operation until bushing is in proper position. Starting and stopping will result in a cracked bushing.
5. Check bushing for cracks after installation.

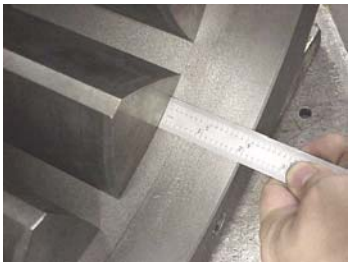


Figure 18, Measure the rotor to casing

Figure 19, Measure the head

BUSHING MATERIALS

Viking bushing material recommendations.

Material	Appearance	Installation Lubricant	Operating Lubrication
Bronze	Yellowish	Not required	Required
Carbon	Black	Soapy Water	Not required
Iron	Steel	Oil or anti-seize	Required
Nitralloy	Steel	Oil or anti-seize	Required
Tungsten	Steel	Oil or anti-seize	Not required

END CLEARANCE ADJUSTMENT

1. The rotor and shaft assembly must be in the casing as far as possible.
2. Measure the distance between the rotor teeth and the outer face of the casing. Figure 18
3. Measure the distance between the mounting surface and the first step on the head. Figure 19
4. Subtract the two measurements and add your required end-clearance.
5. Use 0.015” gaskets to attain the thickness as calculated above.
6. Place the gaskets on the head. Figure 8, page 6.
7. With the idler and bushing on the idler pin, place the head and idler inside the rotor teeth.
8. Rotate into the proper position while pushing the head to the casing.
9. Bolt into place and tighten evenly.

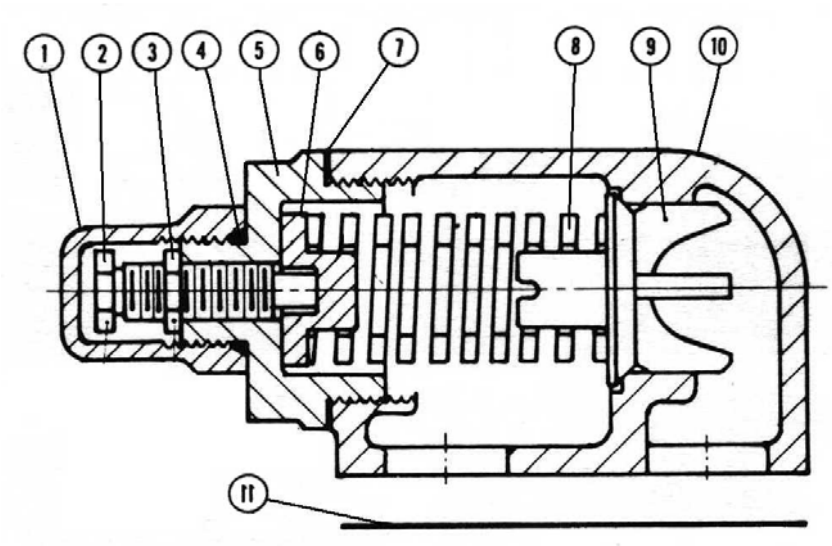
Figure 20, Pneumatic testing

PNEUMATIC TESTING

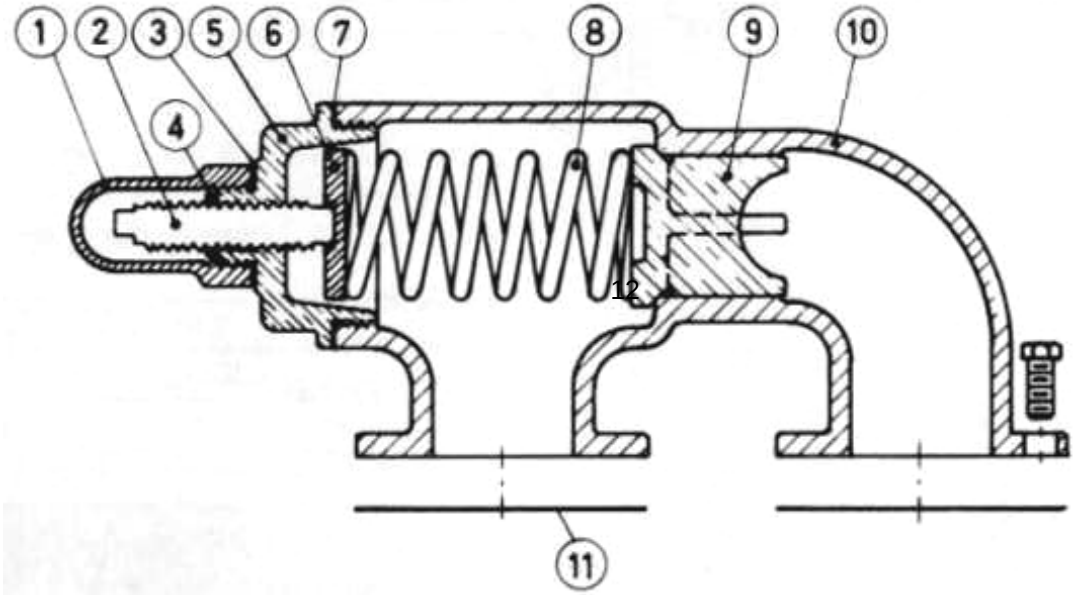
1. Seal the ports with pipe plugs. Be sure to provide a male air line connection to one of the ports.
2. Apply approximately 50 psi of air pressure to the pump. Figure 20
3. Spray or brush the externals with soapy water and watch for growing air bubbles on any pump component. These bubbles will indicate where leaks are occurring.
4. Relieve the pressure from the pump.
5. Carefully disconnect the air supply.
6. Remove the plugs or covers from the ports.
7. Return the pump to service.

PRESSURE RELIEF VALVE INSTRUCTIONS

“A” Size



“B” & “C” Size



ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Bonnet	4	Lock nut	7	Cap Gasket	10	Relief valve body
2	Adjusting Screw	5	End cap	8	Spring	11	Relief valve port gasket
3	Bonnet o-ring	6	Spring Guide	9	Poppet		

DISASSEMBLY

Mark valve and head before disassembly to insure proper reassembly.

1. Remove bonnet.
2. Measure and record length of adjusting screw protruding out of the end cap.
3. Loosen locknut and back out adjusting screw until spring pressure is released.
4. Remove relief valve cap, spring guide, spring and poppet from valve body. Clean and inspect all parts for wear or damage and replace as necessary.

ASSEMBLY

1. Clean and inspect all parts for wear or damage and replace as necessary. Insert the poppet, spring, and spring guide into the valve body. Figures 21, 22
2. Put two gaskets on the cap, and install it into the relief valve body.
3. Put the adjusting screw into the relief valve cap so that the portion protruding out of the end cap is the same as that measured from disassembly. Figure 23
4. Lock the adjusting screw into location with the lock nut.
5. Put the o-ring over the threads on the relief valve cap and install the bonnet. Figure 24

If valve is removed for repairs, be sure to replace in same position. Relief valve adjusting screw cap must *always* point towards suction side of pump. If pump rotation is reversed, remove relief valve and turn end for end. Refer to Figures 2, 3, page 2.

PRESSURE ADJUSTMENT

If a new spring is installed or if the pressure setting of pressure relief valve is to be changed from that which the factory has set, the following instructions must be carefully followed:

1. Install a pressure gauge in discharge line for actual adjustment operation. **Do this with all pressure relieved from the system.**
2. Carefully remove the bonnet which covers the adjusting screw.
3. Loosen the lock nut which locks the adjusting screw so that the pressure setting will not change during operation of pump.
4. With the pump operating, read the pressure from the gauge. There will be a leak around the adjusting screw.
5. Turn adjusting screw in to increase pressure and out to decrease pressure. Remember that the relief valve should not open during normal conditions.
6. Closing a valve in the piping will stopping all flow. A pressure gauge on the discharge port of the pump will show the maximum pressure that the relief valve will allow while pump is in operation.

IMPORTANT: When ordering parts for pressure relief valve, always give model number and serial number of pump as it appears on nameplate and name of part wanted. When ordering springs, be sure to give pressure setting desired.

Figure 21, Poppet

Figure 22, Spring & Retainer

Figure 23, End cap, screw, & nut

Figure 24, Bonnet

Troubleshooting

No Discharge:	Pump priming may be required
	Suction lift is too great
	Relief valve is stuck open
	Strainer needs cleaning
	Wrong direction of rotation
Insufficient Discharge Volume	Air leeks in suction
	Speed is to slow
	Relief valve is set to low
	Suction lift too high for liquid handled. This is very important on hot or volatile fluids
	Suction line is not submerged
	Suction piping too small in diameter, or foot valve is to small
	Wrong rotation
	Pump internals worn
	Air or gases in suction piping
	Viscosity is higher than expected
Insufficient Pressure	Relief valve set to low
	Air or gases in the fluid
	Pump internals are worn
	Insufficient volume being pumped
	Wrong rotation
	Improper clearances in the internals
Loss of suction after a period Of operation	Suction line is leaking (letting air into the pump)
	Packing is too loose or the mechanical seal is leaking
	Leaking Gaskets
Excessive power requirement	Viscosity to high
	Discharge pressure is to high
	Insufficient lubrication
	Shaft or rotor bent, misalignment or packing gland is to tight
Noisy operation with good Performance	Misalignment of coupling
	Worn bearings
Noisy operation with poor or No performance	Cavitation – Not enough fluid getting to the pump
	Worn bearings or bushings
Leaking around the shaft	Packing is loose, or needs replacement
	Mechanical seal is damaged or misaligned
	Shaft is scored
	Shaft is bent

PUMP INSPECTION REPORT DATE:_____

PUMP MODEL: _____ SERIAL NUMBER: _____

CUSTOMER: _____

SALES ORDER NUMBER: _____ OTHER REFERENCE: _____

APPLICATION AND/OR PROBLEM: _____

_____

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DESCRIPTION	STANDARD DIMENSIONS	EX. CL. (IF ANY)	ACTUAL	WEAR
ROTOR O.D.				
ROTOR I.D.				
ROTOR TOOTH LENGTH				
IDLER O.D.				
IDLER (BUSHING) I.D.				
IDLER TOOTH LENGTH				
IDLER PIN O.D.				
SHAFT O.D.				
SHAFT BUSHING I.D.				
CRESCENT LENGTH				
CASING I.D.				
END CLEARANCE				

COMMENTS & RECOMMENDATIONS:_____

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WARRANTY

Viking warrants all products manufactured by it to be free from defects in workmanship or material for a period of one (1) year from date of startup, provided that in no event shall this warranty extend more than eighteen (18) months from the date of shipment from Viking. If, during said warranty period, any products sold by Viking prove to be defective in workmanship or material under normal use and service, and if such products are returned to Viking's factory at Windsor, Ontario, transportation charges prepaid, and if the products are found by Viking to be defective in workmanship or material, they will be replaced or repaired free of charge, FOB. Windsor, Ontario.

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